

The genus *Cacodaemon* (Coleoptera, Endomychidae) of Vietnam

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Abstract

The species of the genus *Cacodaemon* of Vietnam are revised. A new species, *Cacodaemon vietnamensis* sp. nov., is described and *C. laotinus laotinus* (Arrow, 1920) is newly recorded from Vietnam. A previously known species, *C. proavus* Strohecker, 1964 is redescribed based on an additional female specimen and a key to species of the genus *Cacodaemon* in Vietnam is provided.

Keywords

Coccinelloidea, handsome fungus beetles, Lycoperdininae, new species, Oriental Region, taxonomy

Introduction

Lycoperdininae is the largest group of the family Endomychidae and is divided into five generic groups (Tomaszewska 2005). The *Amphisternus* group (sensu Tomaszewska 2005, 2006; = “*Amphisternini*” of Strohecker 1964) contains ten Oriental genera (Tomaszewska 2005, 2006; Chang and Ren 2013): *Amphisternus*, *Amphistethus*, *Blachytrycherus*, *Cacodaemon*, *Gerstaeckerus*, *Humerus*, *Ohtaius*, *Spathomeles*, *Stictomele* and *Stroheckeria*. Some of these genera have a unique characteristic of the elytra, the possession of high tubercles and/or spines (Tomaszewska 2005).

Cacodaemon Thomson, 1857 is an endomychid genus most famous for its unusual spiky appearance, with 26 known species/subspecies from Southeast Asia (Shockley et al. 2009). From the Indochina Subregion, only two species are recorded: *C. proavus* Strohecker, 1964 from Vietnam and *C. laotinus laotinus* (Arrow, 1920) from Laos and China. The Sundaic species, *Cacodaemon bellicosus* (Gerstaecker, 1857), was recorded from China (Shockley et al. 2009), but this record was a misidentification of *C. laotinus* (as *Amphisternus bellicosus* var. *laotinus* Arrow, 1920). This species should be omitted from the Chinese fauna.

In the present paper, we review the species of *Cacodaemon* known from Vietnam and describe a new species.

Material and methods

The materials examined in this paper are preserved in the Ehime University Museum, Matsuyama, Japan (**EUMJ**), National Institute of Agrobiological Sciences, Tsukuba, Japan (**NIAS**), National Museum of Nature and Science, Tsukuba, Japan (**NSMT**), Hokkaido University Museum, Sapporo, Japan (**SEHU**), and Vietnam National Museum of Nature (**VNMN**). General observations, dissections and microstructures of dissected parts were made and photographs were taken under a Leica MZ95 stereo microscope. After observation, the dissected parts were mounted on the same card with the specimen.

Morphological abbreviations used in this study are as follows:

EL	elytral length from anterior margin to elytral apex;
EWH	maximum elytral width across humeral appendages;
EWM	maximum elytral width in base of humeral appendages;
PLM	pronotal length in median line;
PLS	pronotal length from anterior angle to posterior margin;
PWA	pronotal width in anterior angles;
PWP	pronotal width in posterior angles;
TL	total length (PLM + EL).

The average is given in parentheses after the range.

Naming system and the abbreviations of elytral appendages are as follows (see also Figure 1 and Yoshitomi (2020)):

BA	basal appendage of elytra;
HA	humeral appendage of elytra;
DA	discal appendage of elytra;
PA	preapical appendage of elytra.

Morphological terminology follows Tomaszewska (2005), Yoshitomi and Sogoh (2019) and Yoshitomi (2020). The label data of the specimen examined is cited verbatim in the original spelling and given inside quotation marks (“...”).

Taxonomy

Cacodaemon Thomson, 1857

Type species. *Eumorphus satanus* Thomson, 1856 (designated by Strohecker 1964).

Diagnosis. The genus *Cacodaemon* is closely related to the genus *Amphisternus* Germar, 1843, but differs from it by the following characteristics: elytral appendages spinous in most species (with tubercles or carinae in *Amphisternus*); maxillary lacinia without tuft of S-like setae at apex (present in *Amphisternus*); intercoxal process of metaventrete subparallel-sided (widening in *Amphisternus*) (after Tomaszewska 2005).

Biological notes. Little is known about the ecology of *Cacodaemon* species. Adults can be collected from fungi growing on the underside of wood (Endo, personal communication).

Key to the species of the genus *Cacodaemon* in Vietnam

1	HA forming long spines, projecting laterally; DA in form of short spines 2
-	HA forming semicircular flat projections, projecting laterally; DA rounded..
 <i>C. proavus</i>
2	Smaller species, TL 7.1 mm; PA consisting of two pairs of tubercles
 <i>C. vietnamensis</i> sp. nov.
-	Larger species, TL 9.0–10.9 mm; PA consisting of one pair of tubercles
 <i>C. laotinus laotinus</i>

Cacodaemon laotinus laotinus (Arrow, 1920)

Figs 1A–1D, 2A–2D, 3A–3D, 4A–4H, 5A, 5B

Amphisternus bellicosus var. *laotinus* Arrow, 1920: 322.

Amphisternus laotinus: Arrow 1928: 343; Strohecker 1953: 110.

Cacodaemon laotinus: Strohecker 1964: 350; Shockley et al. 2009: 36.

Material examined. 1 male & 1 female (EUMJ), “[LAOS] East Nong Het Xieng Khouang Prov. 25. VI. 2006 J. Yamasako leg.”; 3 males & 1 female (NIAS, VNMN), “Tam Dao N. Vietnam June 1996”, “T. Kumasawa Collection”; 1 female (NIAS), “Tam Dao N. Vietnam 1 May 1997”, “T. Kumasawa Collection”; 4 males & 1 female (SEHU), “Tam Dao VI 1994”, “A. TANAKA Coll. (田中 明) SEHU JAPAN 2005”.

Diagnosis. This is a distinct species in the genus by having the following characteristics: elytral appendages, apical parts of femur, and antennomere 1 tinged with orange/dull orange; DA conoidal, not simply pointed.

Redescription. Male. Body (Fig. 1A, 1C) oval, convex dorsally, weakly shiny. Coloration of body black; BA, DA, PA, humeral parts, and apical parts of femur orange; antennomere 1 I and anterolateral corners of pronotum dull orange.

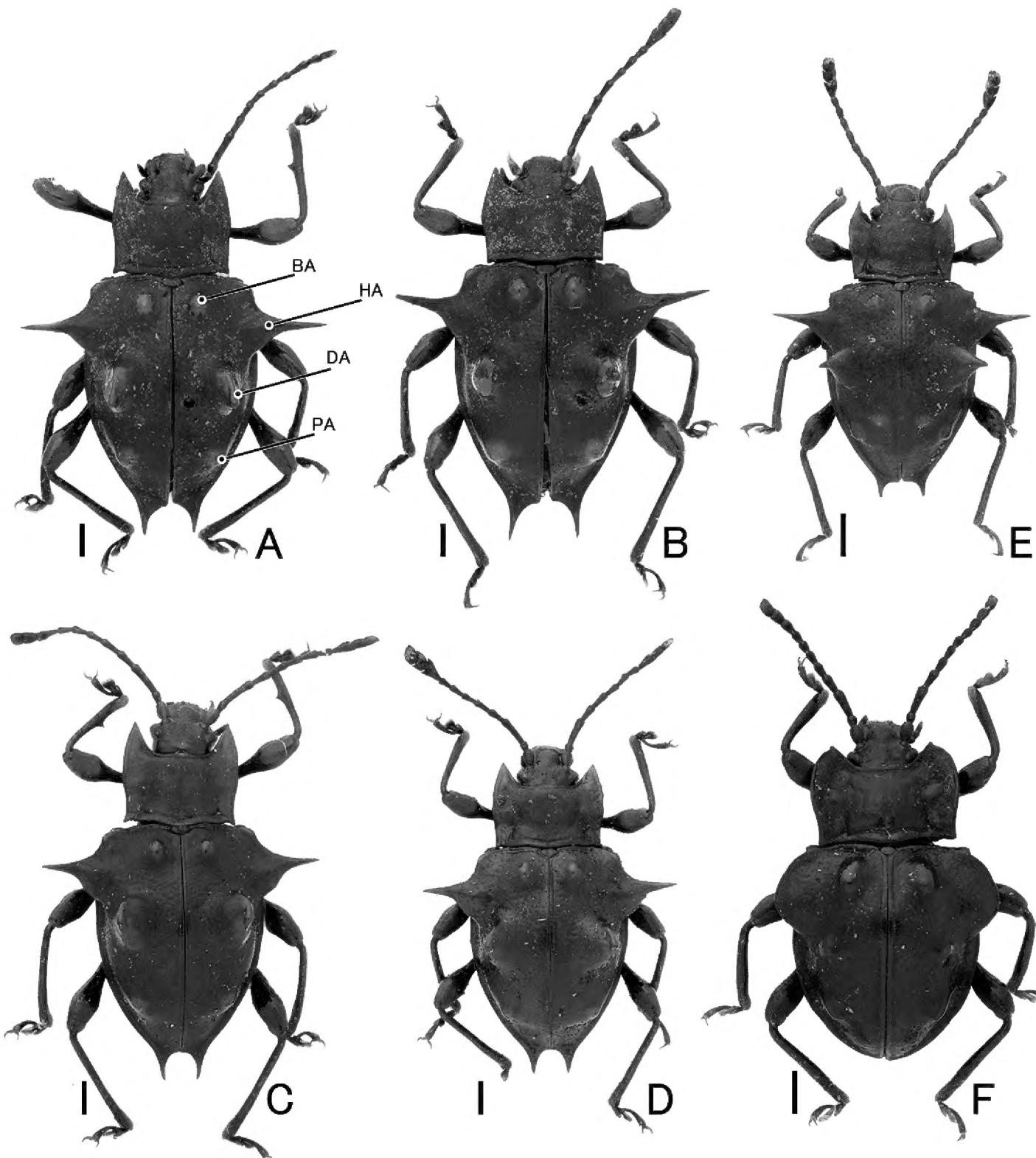


Figure 1. Habitus of *Cacodaemon* spp. **A–D** *C. laotinus laotinus*, Vietnamese specimens (**A, B**) and Laotian specimens (**C, D**) **E** *C. vietnamensis* sp. nov., holotype **F** *C. proavus* **A, B** male **C, D–F** female. Scales: 1.0 mm.

Head finely punctate. Antennae long and slender; antennomere 3 longest, a little shorter than 4 and 5 combined; club (antennomeres 9–11) distinctly wide. Pronotum impunctate, microreticulate, widest at middle; basal and lateral grooves shallow; front corners projecting and pointed; lateral margins slightly tapered anteriorly and posteriorly; posterior corners slightly projecting posterolaterally; PLM/PLS 0.74–0.77 (0.75); PWM/PWA 1.14–1.23 (1.20); PWM/PLM 1.43–1.52 (1.49); PWM/PLS 1.06–1.17 (1.12). Fore tibia (Fig. 2A, 2C) straight and long, slender, with a sharp denticle at middle of inner margin. Elytra (Fig. 3A, 3C) finely

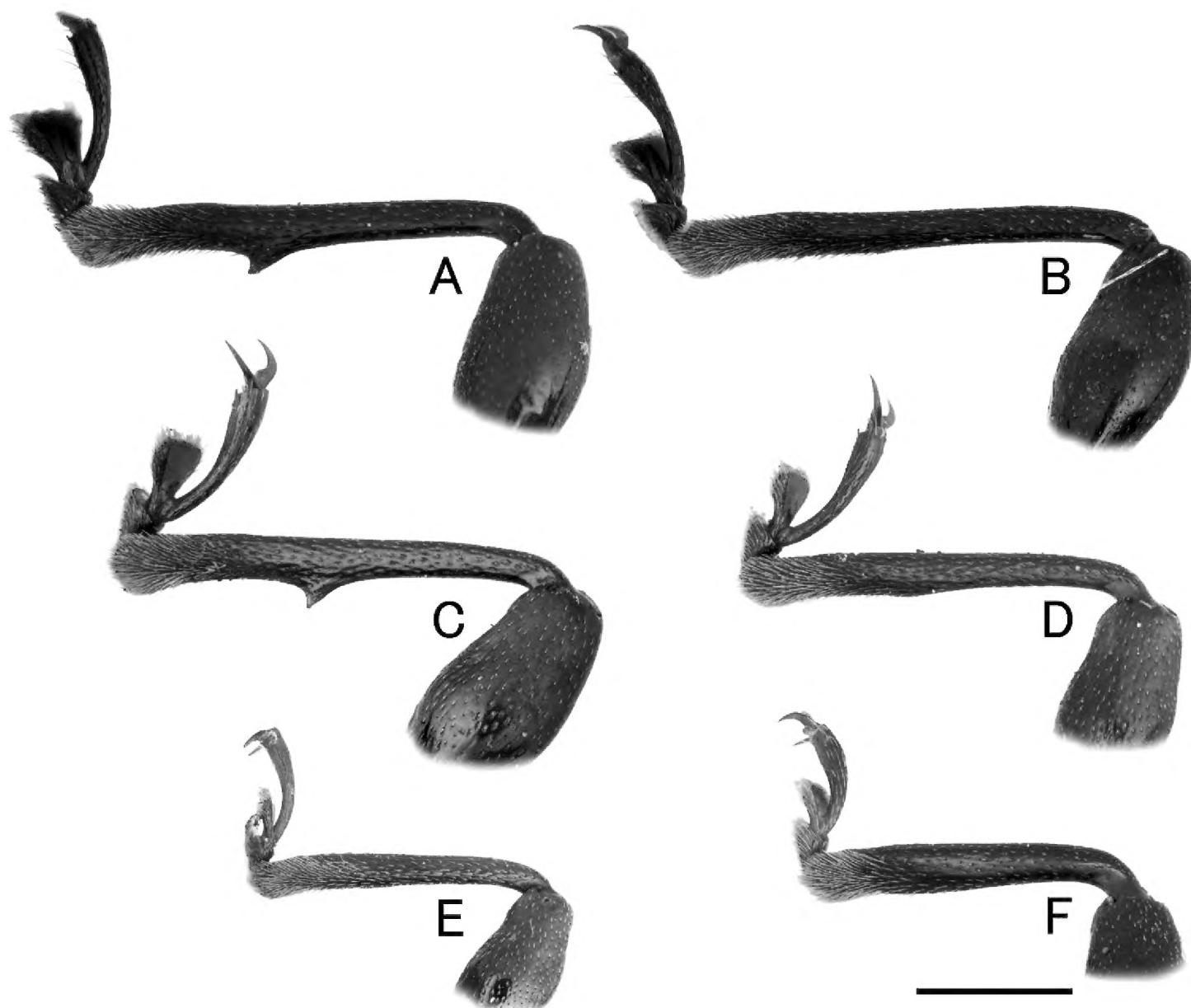


Figure 2. Fore tibiae of *Cacodaemon* spp. **A–D** *C. laotinus laotinus*, Vietnamese specimens (**A, B**) and Laotian specimens (**C, D**) **E** *C. vietnamensis* sp. nov., holotype **F** *C. proavus* **A, C** male **B, D–F** female. Scale: 1.0 mm.

and sparsely punctate, microreticulate; BA large tubercle; HA long spine, projecting laterally, stout in basal part; DA projecting dorsally, conoidal, with small spine or dull apex, stout in basal part; PA a pair of tubercles; apex of elytra with long spines; EL/EWH 0.90–0.92 (0.91); EL/PLM 3.43–3.51 (3.46); EWH/PWM 2.46–2.67 (2.58); EWH/PWM 1.73–1.67 (1.71); TL/EWH 1.15–1.19 (1.17). Aedeagus (Fig. 4) stout; apical branch (ab) short, with acute apex; subapical branch (sb) long, slightly curved, with pointed apex.

Female (Figs 1B, 1I, 3B, 3D). Sexual dimorphism distinct in the following characteristics: fore tibia (Fig. 2B, 2D) straight and long, lacking denticle; posterior corners of pronotum right-angled. PLM/PLS 0.73–0.74 (0.74); PWM/PWA 1.26–1.27 (1.27); PWM/PLM 1.52–1.57 (1.54); PWM/PLS 1.13–1.14 (1.14); EL/EWH 0.92; EL/PLM 3.43–3.74 (3.59); EWH/PWM 2.46–2.58 (2.52); EWH/EWM 1.76–1.72 (1.74); TL/EWH 1.17–1.19 (1.18). Sternite VIII (Fig. 5A) deeply emarginate at posterior margin. Ovipositor (Fig. 5B) bearing long setae along lateral margins of fused coxites; posterior margin of fused coxites arcuate; styli bearing long setae.

Measurement. Male from Vietnam ($N = 3$). TL 10.20–10.45 (10.34) mm; PWM 3.30–3.58 (3.44) mm; PWA 2.80–2.90 (2.87) mm; PLM 2.30–2.35 (2.32) mm; PLS 3.05–3.10 (3.08) mm; EL 7.90–8.10 (8.03) mm; EWH 8.80–9.00 (8.87) mm; EWM 5.10–5.40 (5.20) mm. Male from Laos ($N = 1$). TL 10.10 mm; PWM 3.45 mm; PWA 2.80 mm; PLM 2.30 mm; PLS 3.10 mm; EL 7.80 mm; EWH 8.28 mm; EWM 5.00 mm. Female from Vietnam ($N = 2$). TL 10.20–10.90 (10.55) mm; PWM 3.50–3.60 (3.55) mm; PWA 2.75–2.85 (2.80) mm; PLM 2.30 mm; PLS 3.10–3.15 (3.13) mm; EL 7.90–8.60 (8.25) mm; EWH 8.60–9.30 (8.95) mm; EWM 4.90–5.40 (5.15) mm. Female from Laos ($N = 1$). TL 9.00 mm; PWM 3.25 mm; PWA 2.70 mm; PLM 2.00 mm; PLS 3.00 mm; EL 7.00 mm; EWH 7.60 mm; EWM 4.70 mm.

Distribution. Laos, Vietnam (new record).

Remarks. As already mentioned by Strohecker (1964), *Cacodaemon laotinus yunnanensis* (Kryzhanovskij, 1960) described from Yunnan (China), is thought to be an infraspecific variation. We do not treat this subspecies in this paper because the holotype could not be examined.

Cacodaemon vietnamensis sp. nov.

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Figs 1E, 2E, 3E, 5C, 5D

Material examined. **Holotype**, female (EUMJ), “Bao Lac 27 km S. Vietnam 29-IV-2007 Y. YOKOI leg.”, [“Bao Lac” is probably misspelling of “Bao Loc” Lam Dong Province, S. Vietnam].

Diagnosis. This species is similar to *C. laotinus laotinus* in having conoidal DA and dull orange elytral appendages but differs from it by the following characteristics: TL smaller, PA consisting of two pairs of small tubercles.

Description. Female. Body (Fig. 1E) oval, convex dorsally, weakly shiny. Coloration of body black; BA, DA, PA, antennomere 1 and anterolateral corners of pronotum dull orange.

Head finely punctate, closely covered with short setae. Antennae long and slender; antennomere 3 longest, a little shorter than 4 and combined; club (antennomeres 9–11) distinctly wide. Pronotum closely punctate, microreticulate, widest at apical 1/3, basal and lateral grooves deep and distinct; front corners projecting and pointed; lateral margins straight, slightly tapered posteriorly from apical 1/3; posterior corners right-angled; PLM/PLS 0.79; PWM/PWA 1.24; PWM/PLM 1.53; PWM/PLS 1.21. Fore tibia (Fig. 2E) straight and long, relatively slender. Elytra (Fig. 3E) coarsely and closely covered with shallow punctures, microreticulate; BA tubercle; HA long spine, stout in basal parts, projecting laterally; DA projecting dorsally, conoidal, with a small spine, stout in basal part; PA consisting of two pairs of small tubercles; apex of elytra with short spines; EL/EWH 0.85; EL/PLM 3.18; EWH/PWM 2.43; EWH/EWM 1.62; TL/EWH 1.12.

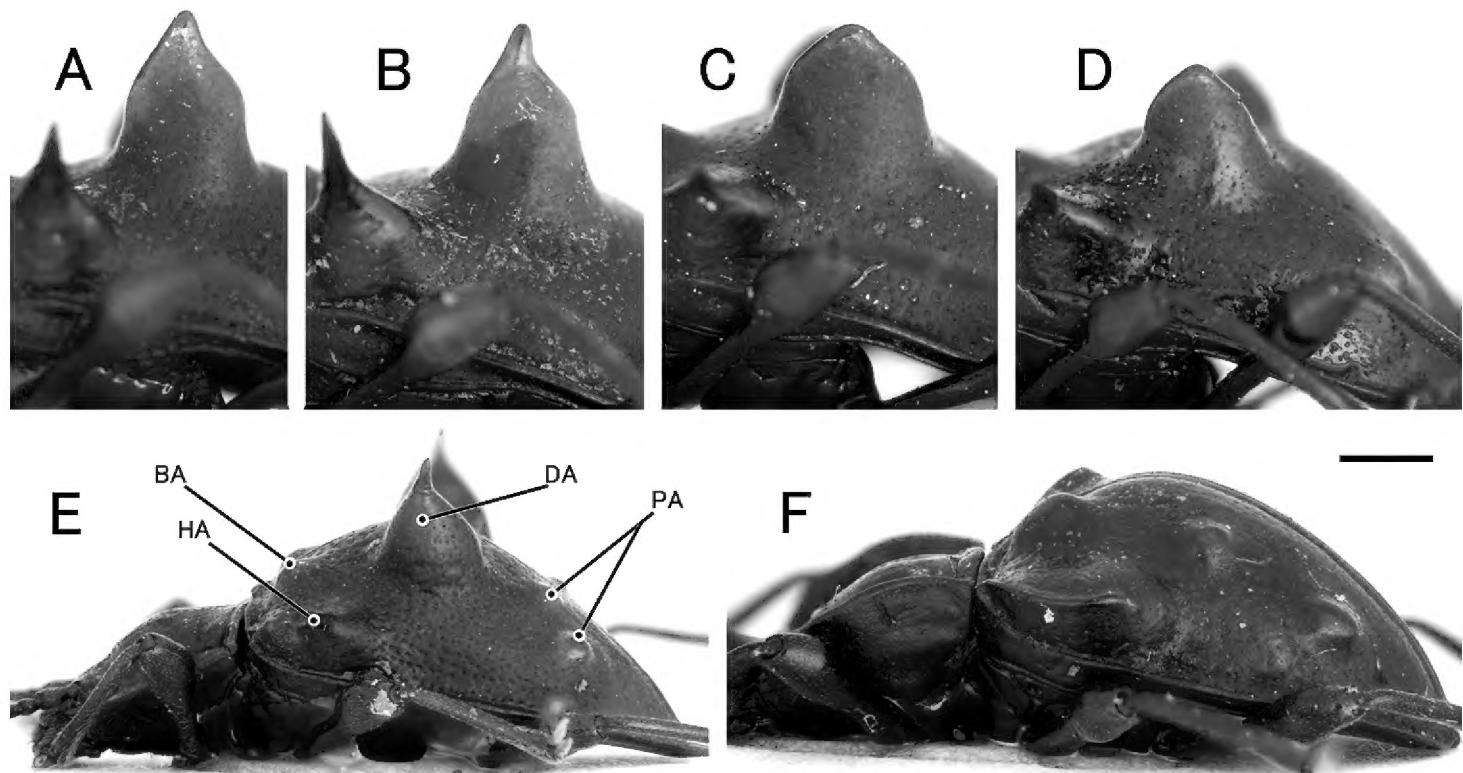


Figure 3. Elytral appendages of *Cacodaemon* spp. in lateral view **A–D** *C. laotinus laotinus*, Vietnamese specimens (**A, B**) and Laotian specimens (**C, D**) **E** *C. vietnamensis* sp. nov., holotype **F** *C. proavus*. **A, C** male **B, D–F** female. Scale: 1.0 mm.

Sternite VIII (Fig. 5C) with tuft of short setae in postero-lateral margins of coxites; posterior margin of fused coxites gently arcuate; styli bearing short setae.

Measurement. Female ($N = 1$). TL 7.10 mm; PWM 2.60 mm; PWA 2.10 mm; PLM 1.70 mm; PLS 2.15 mm; EL 5.40 mm; EWH 6.33 mm; EWM 3.90 mm.

Distribution. Vietnam.

Etymology. Named after the type locality.

Cacodaemon proavus Strohecker, 1964

Figs 1F, 2F, 3F, 5E, 5F

Cacodaemon proavus Strohecker, 1964: 346; Shockley et al. 2009: 36.

Material examined. 1 female (NSMT), “Mt. Pia Oac (LT: 1,200m) Cao Bang Prov. [N-VIETNAM] 22. V. 1999, S. Nomura leg.”.

Diagnosis. This is a distinct species in the genus by having the following characteristics: BA, DA, PA in the form of tubercles; HA carinate; apex of elytra rounded. In general appearance, this species is similar to *Amphisternus sordidus* Arrow, 1928 known from Vietnam and Laos, but differs from it by the mat and smooth dorsal surface (shiny and rugose in *A. sordidus*), widely carinate HA (narrowly carinate in *A. sordidus*), and BA in the form of a tubercle (carinate in *A. sordidus*).

Redescription. Female. Body (Fig. 1F) oval, slightly convex dorsally, weakly shiny. Coloration of body black, but DA and PA faintly dull orange.

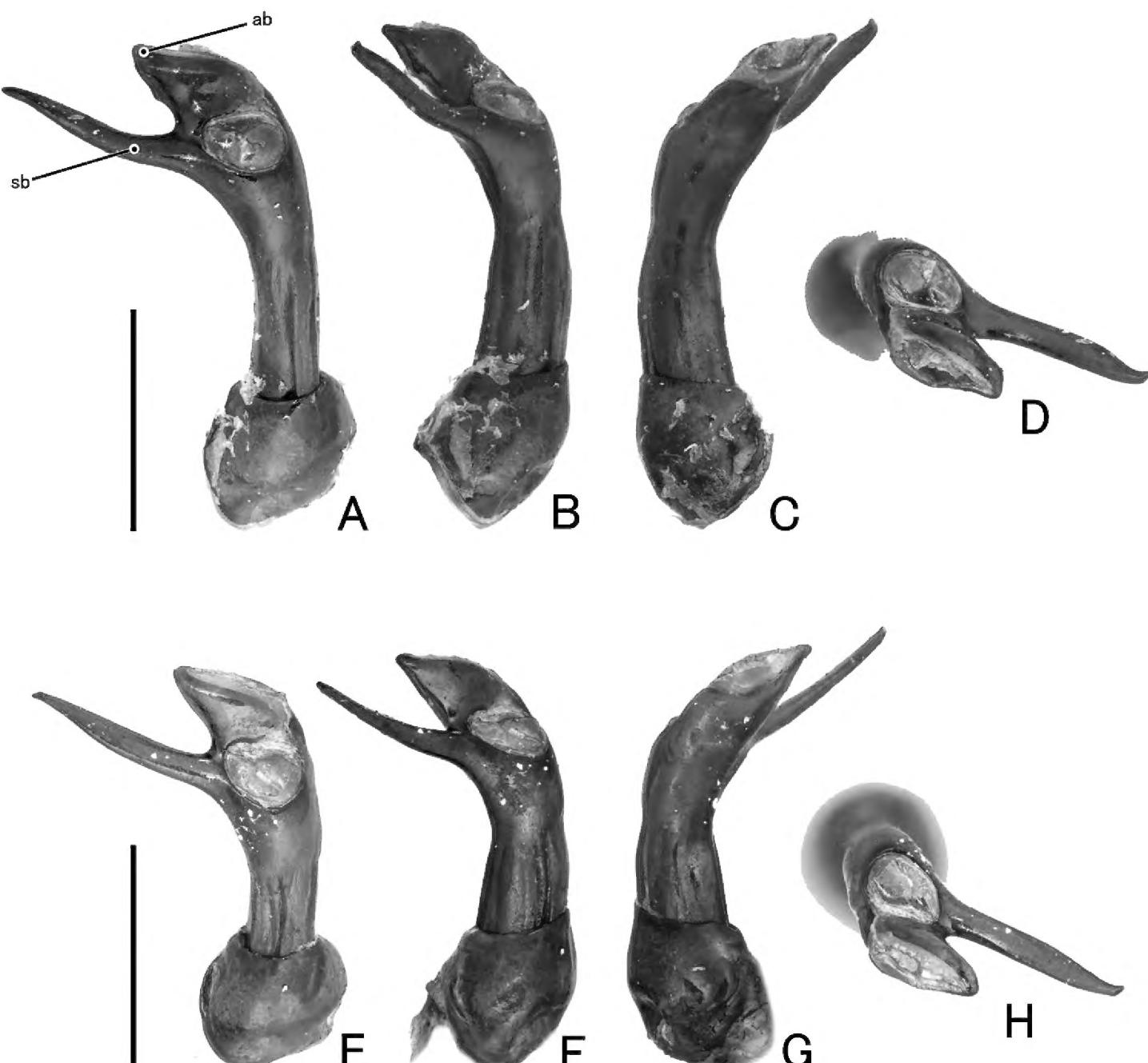


Figure 4. Aedeagus of *Cacodaemon laotinus laotinus* **A–D** vietnamese specimen **E–H** laotian specimen. **A, E** dorsal **B, F** lateral **C, G** ventral **D, H** apical. Abbreviations ab: apical branch; sb: subapical branch. Scales: 1.0 mm.

Head moderate in size, finely punctate. Antennae long, relatively stout; antennomere 3 longest, shorter than antennomeres 4 and 5 combined; club (antennomeres 9–11) weakly widened. Pronotum indistinctly and finely punctate, microreticulate, widest at middle, widely upturned in lateral parts; front corners triangular, minutely pointed at apices; lateral margins arcuate; posterior corners right-angled; PLM/PLS 0.75; PWM/PWA 1.52; PWM/PLM 1.80; PWM/PLS 1.35. Fore tibia (Fig. 2F) straight, relatively stout. Elytra (Fig. 3F) minutely and sparsely punctate, microreticulate; basal and lateral grooves shallow; BA in the form of a tubercle; HA carinate; DA tubercle, small and low; PA tubercle, small and low; apex of elytra rounded; EL/EWH 0.99; EL/PLM 2.66; EWH/PWM 1.49; EWH/EWM 1.21; TL/EWH 1.37.

Sternite VIII (Fig. 5E) shallowly concave at posterior margin. Ovipositor (Fig. 5F) bearing short setae along lateral margins of fused coxites; posterior margin of fused coxites weakly protruding; styli bearing short setae.

Male. Not examined. Male genitalia figured by Strohecker (1964).

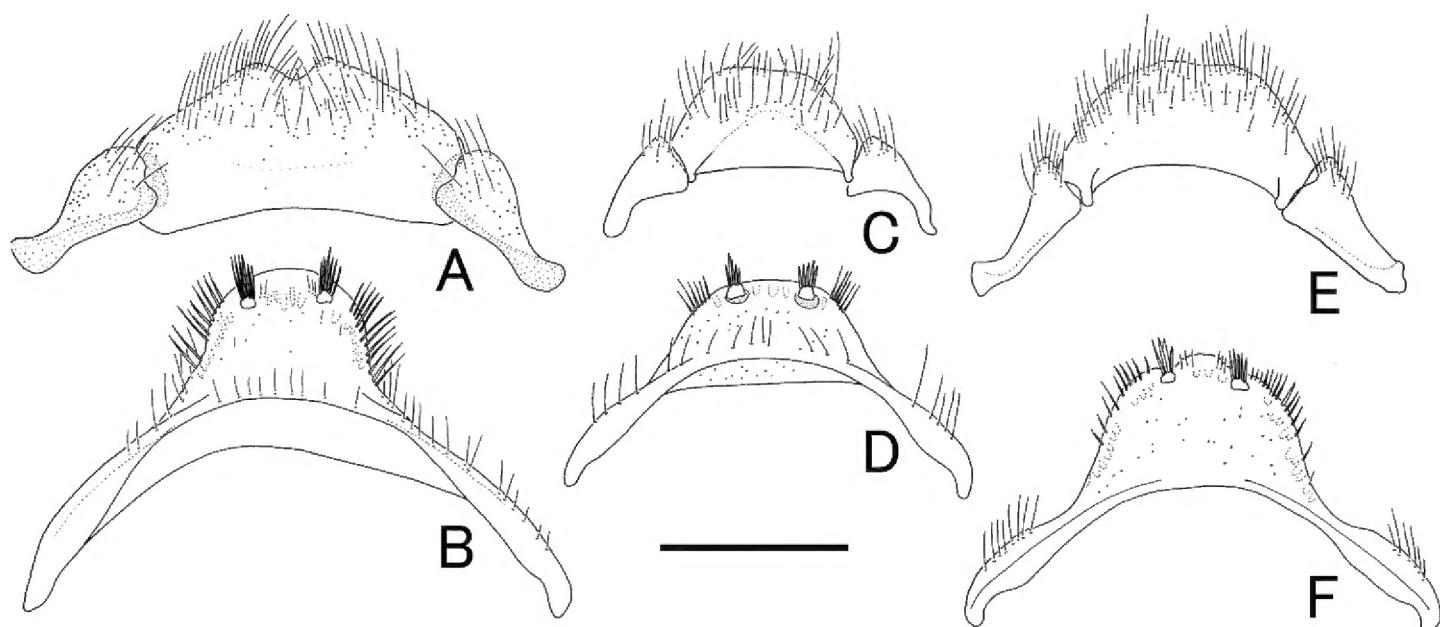


Figure 5. Female genitalia of *Cacodaemon* spp. **A, B** *C. laotinus laotinus* **C, D** *C. vietnamensis* sp. nov. **E, F** *C. proavus* **A, C, E** sternite VIII **B, D, F** ovipositor. Scale: 0.5 mm.

Measurement. Female ($N = 1$). TL 7.43 mm; PWM 3.65 mm; PWA 2.40 mm; PLM 2.03 mm; PLS 2.70 mm; EL 5.40 mm; EWH 5.43 mm; EWM 4.50 mm.

Distribution. Vietnam.

Remarks. Strohecker (1964) described this species based on three specimens collected from “Mauson, Tonkin” (= Mt. Mauson, Loc Binh District, Lang Son Province, Northeastern Vietnam).

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